WATER RESOURCES REVIEW for FEBRUARY 1977

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

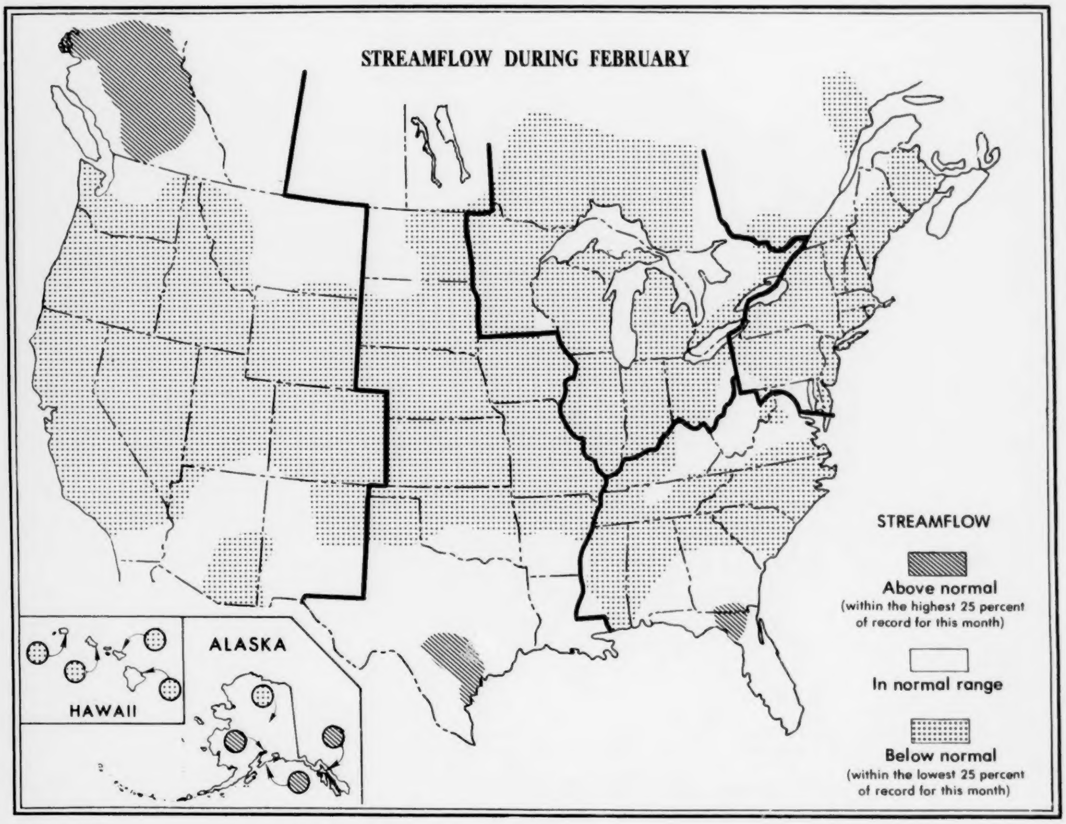
STREAMFLOW AND GROUND-WATER CONDITIONS

Serious drought conditions persisted in large areas of the United States. Critical seasonal water shortages were occurring in northern California and Oregon and parts of adjacent States. Snowpack was far below normal throughout the Western United States. Some water-supply reservoirs in the Far West were lowest of record. In Minnesota and Iowa and parts of adjacent States, streamflows below the normal range have persisted for at least the last 9 consecutive months.

Monthly and daily mean flows were lowest of record in parts of California, Oregon, Washington, Idaho, Colorado, Utah, South Dakota, Wisconsin, Michigan, and also Hawaii.

Above-normal flows persisted in parts of British Columbia, Alaska, Texas, and Florida.

Monthly mean discharge of Mississippi River near Vicksburg, Miss., was 61 percent below the February median flow.



CONTENTS:

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow generally decreased seasonally in northern parts of the region and increased seasonally in the southern coastal States. Flows remained below the normal range in parts of all States in the region and decreased into that range in New Brunswick. Lowland flooding occurred in New Jersey—mostly the result of ice jams. A heavy snowpack remained on the ground in most of the northern States in the region at monthend. Ground-water levels continued to decline in most of the region and remained below normal, reaching lowest or near-lowest levels of the past 20 to 30 years in some wells for this time of year.

In New Jersey, streams tributary to the Delaware River were about 1 foot above flood stage on February 25 as a result of runoff from rains that averaged 2½ inches. Ice jams caused lowland flooding along the Delaware River at Port Jervis, New York during this same period. Monthly mean flows at the index stations, however, remained below the normal range and about 70 percent of median.

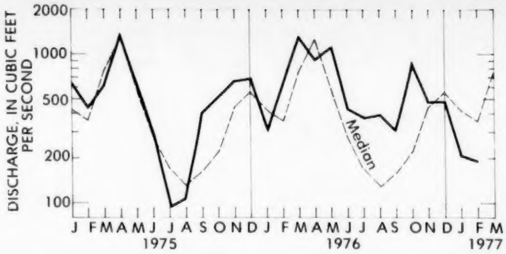
In Pennsylvania, monthly mean flows increased seasonally at all index stations in the State but remained below the normal range and about 60 percent of median except for Monongahela River at Braddock where flows in the normal range prevailed as a result of runoff from snowmelt and rain. By monthend most streams were clear of ice and very little snow remained on the ground. Some lowland flooding was reported but damage was believed to be minimal.

In eastern Maryland, monthly mean flow at the index station, Choptank River near Greensboro, decreased contraseasonally into the below-normal range and was 32 percent of the median flow for February.

In New York, a thick ice cover prevailed on most streams at monthend caused by prolonged below-normal temperatures. An above-normal snowpack holds a potential for severe flooding if coupled with rains and warm weather. Streamflows generally decreased during the month, however, and were below the normal range at all index stations. In the northwestern part of the State, monthly mean flow at West Branch Oswegatchie River near Harrisville decreased seasonally and remained below the normal range for the 2d consecutive month. (See graph.)

In Connecticut, monthly mean flows increased seasonally at all index stations as a result of a rainstorm and snowmelt on February 24–25 but remained below the normal range throughout the State and about 70 percent of median.

In Massachusetts and Rhode Island, monthly mean discharges increased at the index stations but remained in the below-normal range for the 4th consecutive



Monthly mean discharge of West Branch Oswegatchie River near Harrisville, N.Y. (Drainage area, 258 sq mi; 668 sq km)

month. The mean flow of 44.9 cfs at Ware River at Coldbrook, Mass. (drainage area, 96.8 square miles) was only 1 cfs greater than the record minimum February flow at that station (period of record, 49 years).

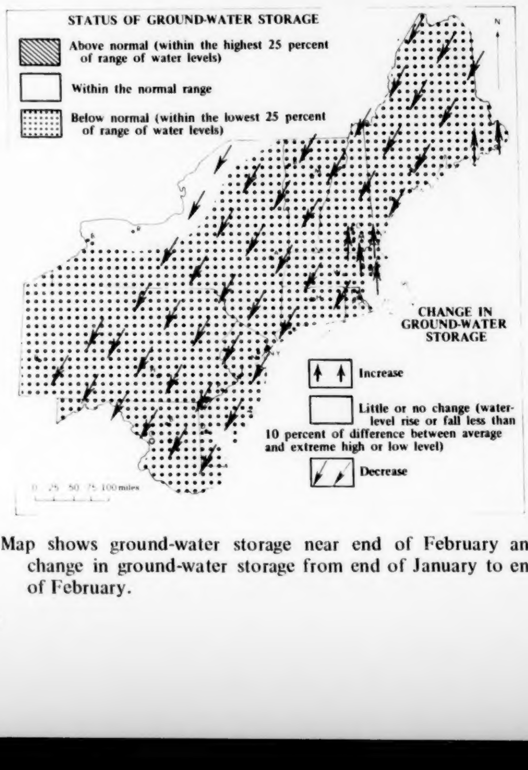
In Vermont and New Hampshire, streamflow decreased seasonally at the index stations and was below the normal range and about 60 percent of the February median flow. At the gaging station, Lamprey River near New Market, N.H. (period of record, 42 years), the lowest February runoff of record occurred.

In Maine, monthly mean flows decreased seasonally and were below the normal range except in the St. John River basin where flows were in the normal range.

Monthly mean flows decreased seasonally in the Atlantic Provinces with flows generally in the normal range in Nova Scotia and in the below-normal range in New Brunswick.

Similarly, in Quebec, streamflows generally decreased seasonally and were in the normal range except that below-normal flows prevailed in the Outardes, St. Francois, and Coulonge River basins.

Ground-water levels generally declined and remained below normal. (See map.) Levels did rise in scattered



Map shows ground-water storage near end of February and change in ground-water storage from end of January to end of February.

areas, including the extreme eastern part of coastal Maine and near-coastal parts of New Hampshire and Massachusetts. Levels near the end of the month in many parts of the region were at or close to the lowest levels for February of the past 20 to 30 years, because of below-normal precipitation and the persisting frozen-ground conditions in many areas preventing recharge of the water table.

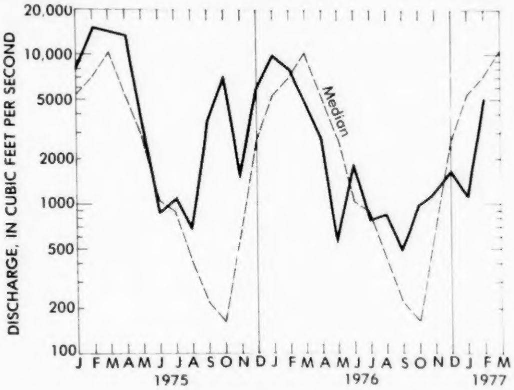
SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow decreased contraseasonally, except in Kentucky, West Virginia, and parts of Tennessee and Virginia where seasonal increases occurred. Flows remained above the normal range in parts of Florida but generally were below that range in northern and southwestern parts of the region. Ground-water levels fluctuated with no general trend. There were local rises, as in Kentucky, where snow melted in response to warmer weather, and local declines, as in Virginia and in artesian aquifers in western Tennessee and central Mississippi. Ground-water conditions were, overall, nearly normal.

In West Virginia, monthly mean flows increased sharply as a result of runoff from rain and snowmelt during the period February 23 to 28. About 90 percent of the total monthly runoff occurred in that period. Monthly mean flows increased into the normal range except in the extreme northern part where flow in Potomac River at Paw Paw increased seasonally but remained below the normal range.

In northern Kentucky, where runoff in Licking River at Catawba was below the normal range in January, monthly mean flow increased sharply in February, as a result of snowmelt runoff, and was in the normal range. (See graph.) In the southern part of that State, monthly mean discharge in Green River at Munfordville also increased but remained below the normal range.



Monthly mean discharge of Licking River at Catawba, Ky. (Drainage area, 3,300 sq mi; 8,547 sq km)

In Virginia, flows continued to decrease contraseasonally and were less than one-half of the February medians, and in the below-normal range, in Nottaway River near Stony Creek and Rapidan River near Culpeper. Elsewhere in the State, flows increased seasonally and were in the normal range.

In Tennessee, monthly mean flows decreased contraseasonally, were below the normal range and about one-third of median, except in the north-central part of the State where flow of Harpeth River near Kingston Springs increased seasonally and remained in the normal range. A few brush fires, which occur rarely in February, were reported in eastern Tennessee during the month.

In North Carolina, monthly mean discharge decreased contraseasonally and was below the normal range at all index stations. In the eastern Piedmont, flow in Neuse River near Clayton decreased sharply into the below-normal range and was only 22 percent of median for the month.

In South Carolina, where monthly mean discharges were above the normal range in January, flows decreased sharply into the below-normal range in Lynches River at Effingham and Pee Dee River at Peedee, as a result of below-normal precipitation.

In Mississippi, where flows during January generally were much greater than median, monthly mean discharges decreased sharply and were below the normal range at all index stations. For example, mean flows in Big Black River near Bovina and Tombigbee River at Columbus were about one-third of the median flow for February.

Similarly, in Alabama, where flows generally were above the normal range in January, monthly mean discharges decreased contraseasonally and were in the below-normal range in Cahaba River at Centreville and Tombigbee River at Demopolis lock and dam, near Coatopa.

In northern Georgia, monthly mean flows in Etowah River at Canton and Oconee River near Greensboro also decreased contraseasonally and were below the normal range. This was the first time since February 1976 that monthly mean flow at Canton has been less than median. Elsewhere in the State, flows were in the normal range.

In northeastern Florida, high carryover flow from January helped to hold monthly mean flow in Suwannee River at Branford in the above-normal range for the 3d consecutive month. In extreme northwestern Florida, flow of Shoal River near Crestview decreased contraseasonally and was in the normal range, following three consecutive months of flow in the above-normal range.

Ground-water levels in West Virginia declined in the eastern panhandle and in the northwestern third of the

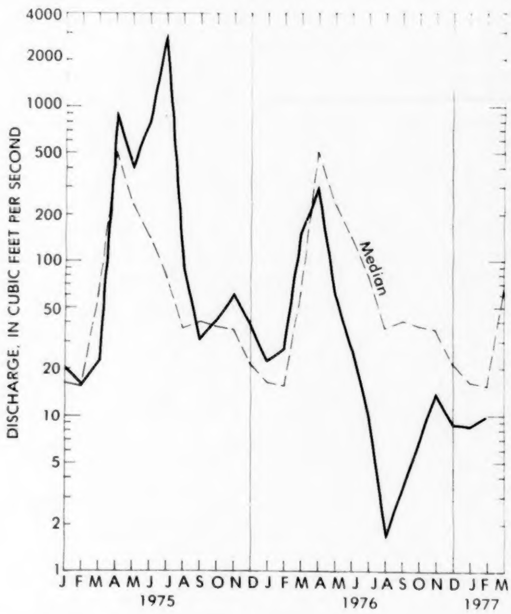
State, but rose elsewhere; levels were below average in the east-southeastern third and above average in most of the remainder of the State. In Kentucky, levels generally rose as higher temperatures melted recent heavy snows and thawed frozen ground to allow recharge of water-table aquifers. In Virginia, levels declined less than a foot and were below average in the three index wells in Fairfax County, Louisa County, and near Petersburg. In western Tennessee, the 5th consecutive new monthly low was noted, for the end of February, in the key well in the "500-foot sand" near Memphis. In North Carolina, levels declined slightly in the Piedmont and Coastal Plain, and rose slightly in the mountains; levels were near-normal in the mountains and below-normal elsewhere. In Mississippi, levels continued to decline—about 0.3 to 1.5 feet—in wells screened in the Sparta Sand in the Jackson area. The artesian pressure in the index well in Montgomery, in central Alabama, rose 2 feet and was nearly a foot above average; in Centreville, the pressure rose 1½ feet and was a foot above average. In Georgia, levels in most wells in the Piedmont were slightly lower than last month and last year, owing to deficient rainfall during the month. In the Savannah area, on the coast, levels in and near the center of pumping ranged from about the same to 2 feet lower than last month and 3 to 9 feet lower than last year. In the outlying area, levels were from 1 to 2 feet lower than last month and 2 to 4 feet lower than last year. In Bryan and Liberty Counties, south of Savannah, levels were slightly lower than last month and about 2 feet lower than last year. In the Brunswick area farther south, levels in and near the center of pumping were about the same as last month and about 2 feet higher than last year. In the outlying area, levels were about the same as last month and last year. Levels declined in most areas of northern and central peninsular Florida during February, ranging from 0.9 foot lower north of Tallahassee to 3.9 feet lower near Mulberry in west-central Polk County; levels ranged from 10.1 feet above average north of Tallahassee to 8.6 feet below near Mulberry. In southeastern Florida, levels continued to decline except in north and central Dade County, where levels were about the same as last month; levels ranged from 0.3 foot above to 1.6 feet below the average.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow generally increased seasonally in most of the region but decreased in parts of Wisconsin and Ontario. Flows remained below the normal range in parts of each State and Province and were lowest of record in parts of Michigan, Wisconsin, and Ontario. Drought conditions persisted in many parts of the region. Ground-water levels generally declined in Minnesota, Wisconsin, and Michigan, and several record lows occurred. Hundreds of shallow wells were reported dry in Minnesota. Elsewhere, there was slight recovery but levels generally continued below average.

In Minnesota, monthly mean discharges remained in the below-normal range except in the Root River basin in the southeastern part of the State. Flows at the four index stations were generally less than 60 percent of the February median and in the below-normal range for at least 10 consecutive months. Typical of the statewide trend was the flow of Buffalo River near Dilworth which remained in the below-normal range for the 10th consecutive month. (See graph.)



Monthly mean discharge of Buffalo River near Dilworth, Minn. (Drainage area, 1,040 sq mi; 2,690 sq km)

In Michigan's Upper Peninsula, the monthly mean discharge of 15.8 cfs at the index station, Sturgeon River near Sidnaw (drainage area, 171 square miles) was less than 30 percent of the February median and a new monthly minimum of record for the 8th consecutive month. The mean daily discharge of 15 cfs which occurred on nine days during the month was also a record low for February. Snowpack along the Lake Superior shore line appears normal, with an unusually heavy

(Continued on page 6.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	February 28, 1977	Monthly mean, February		February		
		1977	1976	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	599.41	599.50	600.65	600.13	601.18 (1975)	598.37 (1926)
Michigan and Huron (Harbor Beach, Mich.)	577.96 -	577.99	579.18	577.69	579.91 (1952)	575.44 (1964)
St. Clair (St. Clair Shores, Mich.)	573.95	574.06	574.56	572.22	575.39 (1974)	569.88 (1926)
Erie (Cleveland, Ohio)	570.17	570.21	571.67	569.72	572.53 (1973)	567.49 (1936)
Ontario (Oswego, N.Y.)	243.73	243.72	244.62	244.08	246.46 (1952)	241.59 (1936)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	February 28, 1977	February 29, 1976	Reference period 1904–76		
			February average, 1904–76	February maximum (year)	February minimum (year)
Elevation in feet above mean sea level:	4,200.65	4,201.20	4,198.4	4,204.7 (1924)	4191.90 (1964)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1975): 102.1 (1869). Alltime low (1939–1975): 92.17 (1941).	February 25, 1977	February 28, 1976	Reference period 1939–75		
			February average, 1939–75	February max. daily (year)	February min. daily (year)
Elevation in feet above mean sea level:	95.08	97.77	95.28	98.30 (1973)	93.64 (1940)

FLORIDA

Site	February 1977		January 1977	February 1976
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	800	96	760	640
Miami Canal at Miami (southeastern Florida)	240	93	236	73
Tamiami Canal outlets, 40-mile bend to Monroe	17.5	110	32	6.2

(Continued from page 4.)
mantle from Munising to Sault Ste Marie. The snowpack was being watched carefully, because of the extended drought, by water managers concerned about depleted storage.

In eastern Ontario, record low monthly mean discharge for any month occurred for the second consecutive month at the index station, Missinaibi River at Mattice (drainage area, 3,450 square miles) where the February monthly mean of 114 cfs was lowest in 57 years of record. Flows at Mattice have been below the normal range for 10 consecutive months. In southwestern Ontario, streamflow at English River at Umfreville increased contraseasonally to 60 percent of the median but remained in the below-normal range for 9 consecutive months.

In Ohio, streamflow was below the normal range in the western and central parts of the State although a warming trend that started February 21, with rain on the 23d, resulted in rising stages on streams throughout the State. Reservoir releases at monthend caused a sharp increase in flow in the Scioto River basin and the monthly mean value was only slightly in the below-normal range.

In Indiana, streamflows increased seasonally as a result of a storm that dropped over 2 inches of rain in the central part of the State at monthend. However, monthly mean discharges remained below the normal range for the 3d consecutive month in the Wabash and White River basins and for the 4th consecutive month at the index station on the Mississinewa River at Marion.

In northwestern Illinois, monthly mean flow in Pecatonica River at Freeport (drainage area, 1,326 square miles) increased seasonally but remained below the normal range for the 9th consecutive month and was only 11 cfs greater than the minimum monthly flow of 293 cfs that occurred in February 1934. In east-central Illinois, the monthly mean flow of Sangamon River at Monticello remained below the normal range for the 4th consecutive month and was less the 10 percent of the February median.

Monthly mean flows at the index stations in Wisconsin continued in the below-normal range for the 10th consecutive month in the Chippewa and Jump River basins, and for the 9th consecutive month in the Wisconsin, Fox, and Oconto River basins. In east-central Wisconsin, the monthly mean discharge of Fox River at Rapide Croche Dam near Wrightstown was the lowest for February since 1897.

Ground-water levels in shallow water-table wells in Minnesota continued to decline and continued below average. The level in the key well near Hanska, in Brown County in south-central Minnesota was the lowest for February in 33 years of record. At Camp Ripley, in Morrison County, in central Minn., the level in the key well was the lowest for February in 24 years of record. In the Minneapolis-St. Paul area, artesian levels declined slightly in wells tapping the Prairie du Chien–Jordan aquifer, and continued to rise in the deeper Mt. Simon-Hinckley aquifer; both were below average at month's end. About 1,900 wells––1,100 of which are in St. Louis County in northeastern Minnesota––have been reported to have gone dry because of the drought; most are only 20 feet deep or less. The impact of the drought has been felt most in the northern and western parts of the State. Some cities that formerly used surface-water supplies have turned to deep ground-water supplies. In Wisconsin, levels were below average in 12 of 16 selected observation wells, but only 2 were at an alltime low for the period of record. In Michigan, extremely low ground-water levels occurred in the western part of the Upper Peninsula; levels in nearly half the observation wells in that area were lowest for their periods of record. Levels in observation wells in most other parts of the State were slightly below average. In northwestern Illinois, the shallow index well in glacial drift at Princeton rose 0.76 foot, reversing its 3-month decline; however, it was still more than 4 feet below average. Owing to frozen ground conditions throughout Indiana, levels remained well below normal but fairly steady; some recovery ocurred in the south by the end of the month. Levels rose about half a foot in the key wells in central and northeastern Ohio, but continued below average.

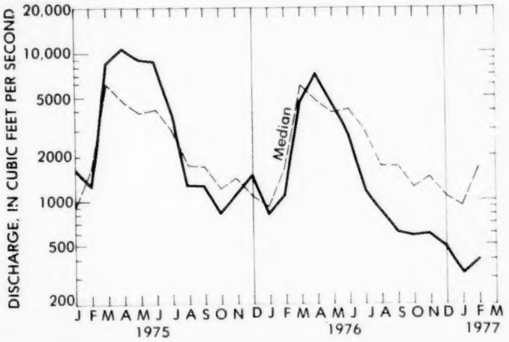
MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow decreased in parts of Manitoba, Louisiana, North Dakota, and Texas, and increased seasonally elsewhere in the region. Flows remained in the below-normal range in all, or parts, of Arkansas, Iowa, Kansas, Missouri, Nebraska, North Dakota, and South Dakota. Monthly mean discharge in Mississippi River at Keokuk, Iowa remained below the normal range for the ninth consecutive month. Above-normal flow persisted in part of Texas. Ice jams on Missouri River between Atchison, Kansas and Yankton, South Dakota broke up during the month without causing flooding. Ground-water levels declined widely in many States, and reached record lows in North Dakota, Iowa, Arkansas, and Texas. Levels rose slightly in much of Nebraska, and locally in northern Iowa, Kansas, Arkansas, Louisiana, and Texas.

In central Iowa, monthly mean flow in Des Moines River below Raccoon River at Des Moines increased

seasonally, remained below the normal range for the 8th consecutive month, and was only 12 percent of median. Upstream at Fort Dodge, monthly mean discharge also increased seasonally but remained in the below-normal range for the 11th consecutive month. In the northeastern part of the State, flow of Cedar River at Cedar Rapids increased but was only one-fourth of median and in the below-normal range for the 8th consecutive month. (See graph.)



Monthly mean discharge of Cedar River at Cedar Rapids, Iowa (Drainage area, 6,510 sq mi; 16,861 sq km)

In northeastern Nebraska, where monthly mean flow in Elkhorn River at Waterloo during January was lowest for that month in 57 years of record, flow during February increased seasonally and was about one-half of median, but was in the below-normal range for the 9th consecutive month. In the northwestern part of the State, monthly mean flow in Niobrara River above Box Butte Reservoir also increased seasonally and was below the normal range for the 4th consecutive month.

In the Big Sioux River basin in eastern South Dakota and the adjacent areas of Minnesota and Iowa, monthly mean discharge as measured on the main stem at Akron, Iowa, increased seasonally but was only 18 percent of median and below the normal range for the 10th consecutive month. In the central part of the State, flow at the index station, Bad River near Fort Pierre, ceased on June 7, 1976 and had not resumed at the end of February. Median flow for February at this station is 0.030 cfs.

In western North Dakota, mild temperatures throughout much of the month resulted in snowmelt runoff and some increase in streamflow. Monthly mean discharge of Cannonball River at Breien increased sharply but remained in the normal range. In the eastern part of the State, mean flow in Red River of the North at Grand Forks increased slightly, was about one-fourth of median for the 5th consecutive month and below the normal range for the 9th time in the past 10 months. In the northwestern part of the State, the monthend level of Lake Sakakawea, mainstem reservoir on Missouri River, was the lowest since 1969.

In Manitoba, monthly mean discharge in Waterhen River below Waterhen Lake continued to decrease seasonally and was less than median for the 3d consecutive month. The level of Lake Winnipeg at Gimli averaged 711.82 feet above mean sea level, 1.21 feet below the long-term mean, and 0.11 foot higher than the average level last month.

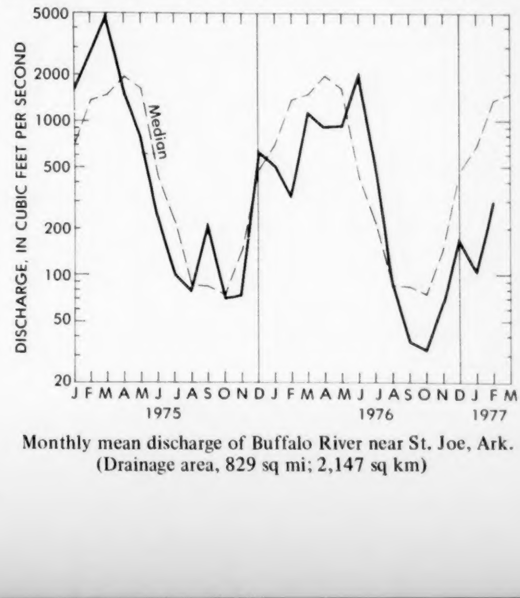
In southern Saskatchewan, monthly mean flow of Qu'Appelle River near Lumsden increased, was near median, and was in the normal range.

In Kansas, monthly mean discharges increased seasonally but remained below the normal range at all index stations. In the northwestern part of the State, mean flow in Saline River near Russell was 3 times the monthly mean flow observed there in January but was below the normal range for the 4th consecutive month and was about one-half median flow for February. In southwestern Kansas, monthly mean discharge in Arkansas River at Arkansas City also increased but was below the normal range for the 7th consecutive month and was less than one-half of median. In the north-central part of the State, flow in Little Blue River near Barnes was nearly 2 times the monthly mean discharge observed there in January but was only about one-half of the February median and was below the normal range.

In northwestern Missouri, monthly mean flow of Grand River near Gallatin continued to increase seasonally but was only 10 percent of median and in the below-normal range for the 4th consecutive month. In the south-central part of the State, flow in Gasconade River at Jerome also increased seasonally, was below the normal range for the 9th time in the past 10 months, and was about one-third of median for February.

In southwestern Oklahoma, monthly mean discharge at the index station, Washita River near Durwood, continued to increase seasonally but remained below median for the 10th consecutive month.

In northern Arkansas, monthly mean discharge in Buffalo River near St. Joe increased seasonally and was nearly 3 times the mean flow observed there in January but remained below the normal range and was only 22 percent of median. (See graph.) In the southern part of



Monthly mean discharge of Buffalo River near St. Joe, Ark. (Drainage area, 829 sq mi; 2,147 sq km)

the State, flow in Saline River near Rye continued to increase seasonally and remained in the normal range for the 7th consecutive month.

In Louisiana, monthly mean flows decreased contraseasonally in the south, increased seasonally in the north, and remained in the normal range.

In south-central Texas, monthly mean flow in Guadalupe River near Spring Branch decreased slightly but remained in the above-normal range for the 4th consecutive month. In the Panhandle area and upper Red River basin, flows were below the normal range. Elsewhere in the State, flows were in the normal range.

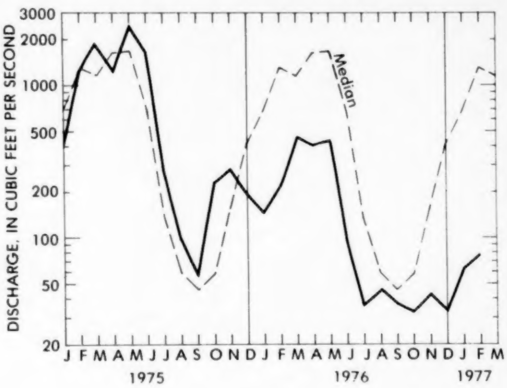
Ground-water levels in North Dakota declined slightly and remained at or near record lows. A new alltime low was reached in the observation well at Wyndmere, N.D., in the eastern part of the State, for the second consecutive month. In Nebraska, levels rose slightly throughout the State, and at month's end were only slightly below average except in areas where levels have been lowered significantly during the past 25 years by heavy irrigation and municipal pumping. In Iowa, levels in water-table wells rose slightly in several northern counties and declined in all other parts of the State. Levels were below average in all observation wells except one in extreme western Iowa. Despite a slight rise, the level in the index well in glacial drift in Linn County, in east-central Iowa, was at a new low for February and nearly 9 feet below average. In Kansas, levels continued to recover slightly in areas of pre-irrigation pumping, but levels in the remainder of the State continued to decline in response to the drought. Levels continued to range from 2 to nearly 6 feet below average in more than 20 years of record. In the rice-growing area of east-central Arkansas, the level in the shallow aquifer declined slightly, but was in the same range that has prevailed since 1964. In the same area, the level in the deep aquifer––Sparta Sand––rose 3¼ feet, reflecting the usual winter rise, but was 1¾ feet below average and 3¼ feet lower than a year ago, reaching a new February low. In the industrial area of central and south Arkansas, the level in the key well at Pine Bluff, also in the Sparta Sand, declined slightly, and was 11½ feet below average and ¾ foot lower than a year ago. At El Dorado, in the same aquifer, the level rose 1¾ feet and was 26 feet higher than in February 1969––the lowest February level on record. Levels rose in the Chicot aquifer of southwestern Louisiana, in the Sparta Sand of northern Louisiana, and in the Miocene deposits of the central part of the State. Levels in aquifers other than the Chicot in the southwest generally declined, as did those in the terrace aquifer of central Louisiana. In Texas, levels in key observation wells were above average in the Edwards Limestone at Austin and San Antonio, but below average in the bolson deposits at El Paso. A new February high level was recorded at San Antonio, and a new February low at El Paso.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow was lowest of record for the month in parts of California, Colorado, Oregon, Utah, and Washington, where severe drought conditions persisted. Monthly mean flows were below the normal range in all, or parts, of each State in the region, but were above the normal range in British Columbia. Monthend snowpack generally was far below normal and was lowest of record at many observation points. Monthend reservoir contents also generally were far below normal in the drought areas. Runoff and snowpack increased slightly in parts of California, Oregon, and Washington near monthend as a result of several rain and snow storms. Ground-water levels declined and were below average in many areas, and new lows for February were noted in wells in Idaho, Montana, Nevada, Arizona, and New Mexico; another well in Nevada reached an alltime record low. Despite the general trend, levels rose in some wells in Washington, Idaho, California, Nevada, Utah, Arizona, and New Mexico. Even so, the levels were generally below long-term averages for the end of February.

In California, streamflow decreased at some index stations and increased at others, but generally remained in the below-normal range for the 4th consecutive month. In the central part of the Sierra Nevada west slope, the monthly mean discharge of 77.2 cfs (6 percent of median), and the daily mean of 41 cfs on the 6th, in North Fork American River at North Fork Dam (drainage area, 342 square miles) were lowest for the month in 36 years of record. (See graph.) Similarly, on the east slope of the central Sierra Nevada, the monthly mean flow of 25.2 cfs (39 percent of median), and the



Monthly mean discharge of North Fork American River at North Fork Dam, Calif. (Drainage area, 342 sq mi; 886 sq km)

daily mean of 15 cfs on the 5th, in West Walker River below Little Walker River, near Coleville (drainage area, 180 square miles) were lowest for February in 39 years of record. In the extreme north-coastal basin of Smith River, the monthly mean discharge of 813 cfs (11 percent of median), and the daily mean of 312 cfs on the 19th, at the index station near Crescent City (drainage area, 609 square miles) were lowest for the month in 46 years of record. This was the 3d consecutive month in which flows were near or below the previously recorded monthly minimums of record at these three sites and was indicative of the persistence of drought conditions in northern and central California. Monthend contents of major reservoirs in northern California were 57 percent of normal and 59 percent of that of a year ago. Water-use conservation measures have been initiated in many communities and also among industrial and agricultural water users. Economic losses increase as the drought continues.

In Oregon, flows also decreased at some index stations and increased at others, but generally remained below the normal range for the 5th consecutive month, reflecting the persistence of drought conditions in all parts of the State. In the south-coastal basin of Umpqua River, the monthly mean discharge of 1,178 cfs (7 percent of median), and the daily mean of 1,110 cfs on the 19th, at the index station near Elkton (drainage area, 3,683 square miles) were the lowest for February in 72 years of record. In the north-coastal basin of Wilson River, the monthly mean flow of 439 cfs at the index station near Tillamook (drainage area, 161 square miles) was 19 percent of median and lowest for the month in 47 years of record. This was the 3d consecutive month in which monthly mean discharges at those two sites have been lowest of record, and is indicative of the severity of drought conditions in those areas. In Willamette River basin in western Oregon, monthly mean flow on the main stem at Salem decreased seasonally, was only 11 percent of the February median flow, and remained in the below-normal range for the 4th consecutive month. In eastern Oregon, monthly mean discharge in John Day River at Service Creek increased slightly, was 20 percent of median for the month, and in the below-normal range for the 4th consecutive month.

In Washington, in the south-coastal basin of Chehalis River, the monthly mean discharge of 1,256 cfs (20 percent of median), and the daily mean of 514 cfs on the 9th, at the index station near Grand Mound (drainage area, 895 square miles) were lowest for the month in 49 years of record. This was the 3d consecutive month in which monthly mean flows have been lowest of record at this station and illustrates the persistence of the drought in that part of the State. In eastern Washington, the monthly mean discharge of 1,060 cfs in Spokane River at Spokane (drainage area, 4,290 square miles) was lowest for February in record that began in April 1891, and was below the normal range for the 4th consecutive month and only 18 percent of median.

In Alberta, monthly mean flow increased slightly in Athabasca River at Hinton and decreased slightly in Bow River at Banff but was in the normal range at each site. In British Columbia, flow in Fraser River at Hope remained in the above-normal range.

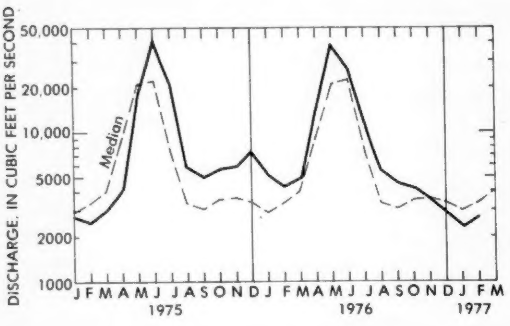
In southwestern Utah, the monthly mean discharge of 9.69 cfs, and the daily mean of 6.1 cfs on the 3d, in Beaver River near Beaver (drainage area, 90.7 square miles) were lowest for February in 63 years of record. This was the 4th consecutive month of record-low monthly mean discharge and the 12th consecutive month of monthly mean flows in the below-normal range, and reflects the persistence of drought conditions in that part of the State. Drought conditions persisted also in northeastern Utah, where monthly mean flow in Weber River near Oakley increased slightly but remained below the normal range for the 6th consecutive month, and monthly mean flow in Whiterocks River near Whiterocks decreased seasonally and was below the normal range for the 5th consecutive month.

In south-central Colorado, in Arkansas River basin, the monthly mean flow of 193 cfs at the index station at Canon City (drainage area, 3,117 square miles) was lowest for February in 89 years of record. This was the 2d consecutive month of record-low monthly mean flow and the 3d consecutive month of flow in the below-normal range, and illustrates the continuing drought conditions in that part of the State. Drought conditions continued also west of the Continental Divide, in southwestern Colorado, where monthly mean flow in Animas River at Durango continued to decrease, and remained below the normal range for the 4th consecutive month. Also west of the Divide, in Yampa River basin, the monthly mean discharge at Steamboat Springs increased slightly but remained below the normal range for the 4th consecutive month.

In Idaho, monthly mean flows increased seasonally in Clearwater River and Salmon River, decreased in Snake River, and were below the normal range at all index stations on those streams and in all other streams in the State. Monthly mean discharge of Coeur d'Alene River at Enaville was lowest for the month in 38 years of record. Contents of Coeur d'Alene and Pend Oreille Lakes, in northern Idaho, were far below normal at monthend, but contents of the major irrigation-water reservoirs in southern Idaho were above normal.

In western Montana, west of the Continental Divide, monthly mean discharge in Middle Fork Flathead River

near West Glacier increased slightly but remained in the below-normal range for the 5th consecutive month. Also on the west slope, monthly mean flow of Clark Fork at St. Regis increased seasonally but remained below the normal range. (See graph.) East of the Divide, flows



Monthly mean discharge of Clark Fork at St. Regis, Mont. (Drainage area, 10,709 sq mi; 27,736 sq km)

increased in Marias River and decreased contraseasonally in Yellowstone River but remained within the normal range in those basins.

In southern Wyoming, monthly mean flow in North Platte River above Seminoe Reservoir, near Sinclair increased seasonally but remained below the normal range. In the northern part of the State, monthly mean flow in Tongue River near Dayton decreased seasonally and was below the normal range for the first month since May 1975.

In New Mexico, monthly mean discharges increased in all parts of the State but generally remained below the February median flows. In the east-central part of the State, flow in Pecos River at Santa Rosa was about one-half of the February median and below the normal range for the 5th consecutive month. In north-central New Mexico, monthly mean flow in Rio Grande below Taos Junction Bridge, near Taos was below the normal range for the 3d consecutive month. In the southwestern part of the State, flow in Gila River near Gila increased slightly, was greater than median, and remained in the normal range.

In the adjacent area of Arizona, monthly mean flow in Gila River at head of Safford Valley, near Solomon decreased seasonally and was below the normal range. In the Salt River basin, in southeastern Arizona, flow at the index station near Roosevelt increased slightly but was below the normal range and less than one-half of median. In the extreme southeastern part of the State, monthly mean discharge in San Pedro River at Charleston decreased seasonally and was below the normal range. Elsewhere in the State, flows decreased contraseasonally and were in the normal range.

Monthend storage in major reservoirs in northern California was 57 percent of normal. In Oregon, storage in Upper Klamath Lake, McKay Reservoir, and Lake Owyhee increased seasonally. Contents of the Colorado River Storage Project decreased 181,010 acre-feet during the month. In the major reservoirs in the Colorado-Big Thompson Project, in northern Colorado, monthend storage was below normal.

Ground-water levels in eastern Washington continued to decline during February; the level in the key well in Spokane Valley was more than 3½ feet below average. The level in the key well in western Washington rose during the month, but continued below average and below the level of a year ago. In Idaho, the level in the well penetrating the sand and gravel aquifer in the Boise Valley continued its seasonal decline and reached a level equal to the lowest in February since 1963. Levels in the key wells representative of the Snake River Plain aquifer declined about 1½ feet in the western and southwestern parts, and only slightly in the south-central part; levels were below average in the western and south-central parts, but nearly a foot above average in the southwestern part at Eden in Jerome County. The level in the well at Atomic City in Bingham County, in the eastern part of the Snake River Plain aquifer, rose slightly and was slightly above average. In the alluvial aquifer of the Rathdrum Prairie in northern Idaho, the level in the observation well declined a little more than a foot but was only slightly below average at month's end. In western Montana, levels in the terrace gravel wells at Missoula and Hamilton declined less than a foot; the level in the well at Missoula was slightly below average, but the level at the Hamilton well was 1.64 feet below average––a new monthly low in 7 years of record. In California, the artesian pressure in the observation well in the Los Alamitos area in Orange County declined nearly 2 feet, and was a little more than 20 feet below average and 8 feet below the level of a year ago. Among the water-table observation wells, the well in Baldwin Park rose 2¼ feet, but continued more than 63 feet below average. The levels in the two key wells in Santa Barbara County declined less than a foot but continued below average––nearly 17 feet at Cuyama, but only about 1½ feet below average at Santa Maria. In Nevada, the level in the well in Steptoe Valley rose slightly and was above average, with a new record high for February. Levels declined slightly in the well at Paradise Valley but continued above average. Levels declined about 3 feet in the wells at Las Vegas and in Truckee Meadows; both were below average and reached new monthly and all-time lows, respectively. In Utah, the level in the artesian well in the Holladay area declined and was more than 10 feet below average, and the level in the artesian well in Flowell rose nearly 2 feet but continued more than 14

feet below average. Pressure levels rose and declined slightly, respectively, in the Logan and Blanding areas, but continued above average, as in the past several months. In Arizona, despite slight rises, new low levels for February were recorded at the water-table index wells at Tucson and Elfrida. Levels in three other index wells declined and were below average; new February lows occurred at the Avra Valley and Litchfield Park wells. In New Mexico, the level in the water-table well west of Hagerman rose more than 2 feet but was nearly 27 feet below average; levels in the other water-table index wells rose or fell slightly and remained below average. The level in the well in the Roswell Artesian Basin in Pecos Valley rose 1¾ feet but was 5 feet below average and at a new February low in 10 years of record.

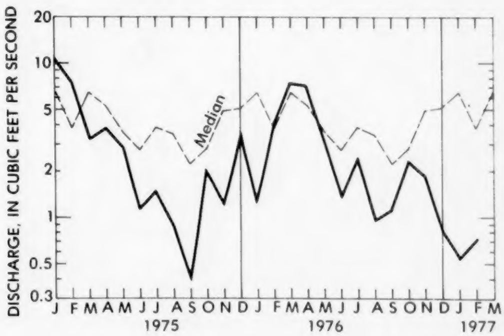
ALASKA

Streamflow increased contraseasonally and was highest of record for the month in the south-coastal areas of the State as a result of unseasonally warm weather. The monthly mean flow of 97.7 cfs, and the daily mean of 256 cfs on the 2d, in Gold Creek near Juneau (drainage area, 9.76 square miles) were highest for February in 31 years of record. This monthly mean discharge is 11 times the February median flow. Similarly, in Kenai River at Cooper Landing (drainage area, 634 square miles), the monthly mean discharge of 1,786 cfs was 4 times the median and highest for February since records began in 1948. Precipitation was about 25 percent greater than normal and occurred as rain, rather than snow, because of the above-normal temperatures. In the interior, flow in Chena River at Fairbanks remained about the same as in January and was below the normal range for the 9th consecutive month. In the adjacent basin of Tanana River, monthly mean flow at Nenana increased contraseasonally and was in the normal range.

Ground-water levels in wells tapping confined aquifers in the Anchorage area rose about 1/2 foot south of the city center and fell one foot or less north and east of the main pumping center in the Ship Creek area. Water levels in the unconfined aquifers remained relatively stable.

HAWAII

Drought conditions continued in the State and streamflow at all index stations remained in the below-normal range. In the Hana area and along the upland western slopes of Haleakala, on the island of Maui, water shortages were serious enough that water use was limited to essential needs only. At Honopou Stream near Huelo (drainage area, 0.64 square mile), the monthly mean discharge of 0.41 cfs (12 percent of median), and the daily mean of 0.38 cfs, February 22–24, were lowest for the month in 66 years of record. On the island of Oahu, the monthly mean discharge of 0.73 cfs in Kalihi Stream near Honolulu (drainage area, 2.61 square miles) was only slightly greater than the February monthly minimum of record, 0.696 cfs (1926), and the daily mean of 0.19 cfs on the 14th was lowest for the month in 63 years of record. (See graph.)



Monthly mean discharge of Kalihi Stream near Honolulu, Oahu
(Drainage area, 2.61 sq mi; 6.76 sq km)

On the island of Kauai, monthly mean flow in East Branch of North Fork Wailua River near Lihue increased contraseasonally from the record-low discharge of January but remained below the normal range for the 4th consecutive month. On the island of Hawaii, monthly mean flow in Waiakea Stream near Mountain View decreased sharply, remained below the normal range, and was only 5 percent of median for the month. The domestic water shortage continued in South Kona and water was being hauled by truck from nearby sources. Because of continuing drought conditions, procedures reportedly were initiated to declare the island a disaster area.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 meter   1 mile = 1.609 kilometers
1 acre = 0.4047 hectare = 4,047 square meters
1 square mile (sq mi) = 259 hectares = 2.59 square kilometers (sq km)
1 acre-foot (ac-ft) = 1,233 cubic meters
1 million cubic feet (mcf) = 28,320 cubic meters
1 cubic foot per second (cfs) = 0.02832 cubic meters per second = 1.699 cubic meters per minute
1 second-foot-day (cfsd) = 2,447 cubic meters
1 million gallons (mg) = 3,785 cubic meters = 3.785 million liters
1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 2.629 cubic meters per minute = 3,785 cubic meters per day

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR FEBRUARY AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	February data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean, in °C	Minimum, in °C	Maximum, in °C
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1977	7,740	99	144	2,060	829	9,410	0.5	0	5.5
	(Morrisville, Pa.)	1945–76	13,700	61	134	......	647	9,580	......	0	8.5
		(Extreme yr)		(1954)	(1951)	......	(1976)	(1976)			
			[10,620[c]]								
04264331	St. Lawrence River at	1977	217,000	167	167	98,000	90,000	104,000	0.5	0.5	0.5
	Cornwall, Ontario, near	1976	260,000	167	168	118,000	110,000	122,000	0.5	0.5	0.5
	Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	1966–76	247,200	......	......	......	......	......	......	0	1.0
			[226,000[c]]								
	SOUTHEAST										
07289000	Mississippi River at	1977	257,200	194	242	154,000	108,000	239,000	3.0	0	5.5
	Vicksburg, Miss	1976	622,400	171	207	329,000	277,000	418,000	7.0	4.5	10.5
			[652,600[c]]								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1977	167,000	182	258	......	48,600	205,000	......	0.5	10.0
	(25 miles west of Paducah,	1955–76	466,700	98	308	......	44,900	419,000	......	0	9.0
	Ky.; streamflow station at Metropolis, Ill.)	(Extreme yr)		(1957)	(1967)	......	(1955)	(1974)			
			[407,600[c]]								
	MIDCONTINENT										
06934500	Missouri River at Hermann,	1977	35,000	383	448	38,800	23,500	79,100	1.5	0	6.0
	Mo. (60 miles west of St. Louis, Mo.)	1976	49,600	330	433	52,000	37,800	74,400	5.0	0	9.0
			[45,700[c]]								
	WEST										
14128910	Columbia River at	1977*	124,600	107	128	42,400	24,800	59,500	5.5	5.5	6.0
	Warrendale, Oreg.	1976	211,500	87	96	51,400	42,300	59,600	6.5	6.0	7.0
	(30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	1968–76	179,600	......	......	......	......	......	......	1.0	7.0
			[126,600[c]]								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved solids and water temperatures are for days 1–12 (only data available for month).

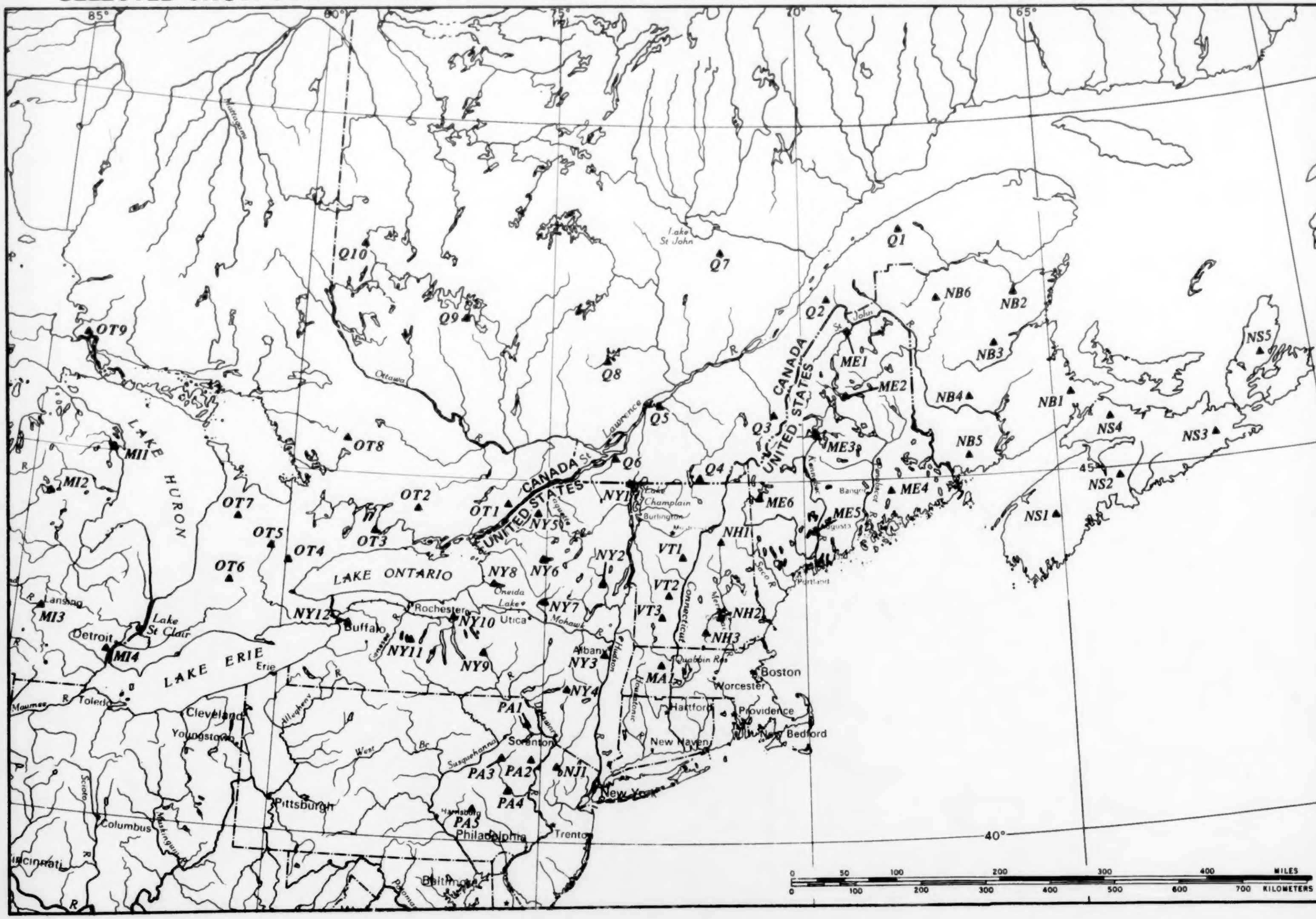
USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF FEBRUARY 1977

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Jan. 1977	End of Feb. 1977	End of Feb. 1976	Average for end of Feb.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	69	67	87	57	226,300 (a)
QUEBEC					
Allard (P)	54	34	54	45	280,600 ac-ft
Gouin (P)	65	56	60	74	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	63	46	50	39	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	35	15	23	17	3,330 mcf
Lake Francis (FPR)	49	26	39	29	4,326 mcf
Lake Winnipesaukee (PR)	64	50	63	50	7,200 mcf
VERMONT					
Harriman (P)	49	27	14	31	5,060 mcf
Somerset (P)	55	45	75	50	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	67	66	78	69	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	42	28	44	35	34,270 mcf
Indian Lake (FMP)	47	34	60	40	4,500 mcf
New York City reservoir system (MW)	84	77	98	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	76	75	101	80	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	15	12	67	26	51,400 mcf
Pymatuning (FMR)	70	73	99	86	8,191 mcf
Raystown Lake (FR)	61	62	68	37	33,190 mcf
Lake Wallenpaupack (PR)	44	38	65	50	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	93	90	100	89	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	67	74	76	84	12,580 mcf
Narrows (Badin Lake) (P)	97	94	93	102	5,617 mcf
High Rock Lake (P)	50	50	55	78	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	78	78	80	68	70,300 mcf
Lakes Marion and Moultrie (P)	89	77	71	75	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	71	65	69	64	75,360 mcf
GEORGIA					
Burton (PR)	55	59	68	68	104,000 ac-ft
Sinclair (MPR)	74	82	88	86	214,000 ac-ft
Lake Sidney Lanier (FMPR)	61	63	63	57	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	70	71	76	76	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	29	25	46	38	1,156,000 cfsd
Douglas Lake (FPR)	10	11	20	22	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	41	39	51	50	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	31	30	47	41	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	30	29	53	48	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	52	49	51	23	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	9	6	28	15	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	11	13	13	18	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	81	79	85	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	63	64	67	76	127,600 ac-ft
Bell Fourche (I)	31	37	56	53	185,200 ac-ft
Lake Francis Case (FIP)	68	71	77	74	4,834,000 ac-ft
Lake Oahe (FIP)	81	85	84	.....	22,530,000 ac-ft
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	103	103	102	94	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	95	86	79	84	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	71	74	80	74	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	67	65	77	84	2,378,000 ac-ft
Keystone (FPR)	62	67	81	92	661,000 ac-ft
Tenkiller Ferry (FPR)	69	71	96	87	628,200 ac-ft
Lake Altus (FIMR)	55	57	95	52	134,500 ac-ft
Lake O'The Cherokees (FPR)	68	69	73	79	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	79	82	86	87	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	92	94	85	42	386,400 ac-ft
Canyon (FMR)	98	98	93	68	385,600 ac-ft
International Amistad (FIMPW)	107	107	100	72	3,497,000 ac-ft
International Falcon (FIMPW)	100	100	86	71	2,667,000 ac-ft
Livingston (IMW)	100	100	100	72	1,788,000 ac-ft
Possum Kingdom (IMPRW)	89	89	90	97	569,400 ac-ft
Red Bluff (PI)	22	22	35	32	307,000 ac-ft
Toledo Bend (P)	87	92	92	80	4,472,000 ac-ft
Twin Buttes (FIM)	100	100	100	17	177,800 ac-ft
Lake Kemp (IMW)	78	78	80	88	268,000 ac-ft
Lake Meredith (FMW)	39	38	43	38	821,300 ac-ft
Lake Travis (FIMPRW)	99	99	94	79	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	40	27	74	42	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	81	53	64	62	5,232,000 ac-ft
Lake Chelan (PR)	38	31	70	36	676,100 ac-ft
Lake Cushman	53	53	80	86	359,500 ac-ft
Lake Merwin (P)	92	77	99	96	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	63	66	66	65	1,235,000 ac-ft
Coeur d'Alene Lake (P)	16	11	56	51	238,500 ac-ft
Pend Oreille Lake (FP)	40	40	57	54	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	70	75	65	71	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	72	69	64	66	802,000 ac-ft
Buffalo Bill (IP)	53	52	59	62	421,300 ac-ft
Keyhole (F)	66	66	68	40	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	57	58	68	46	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	4	5	3	18	364,400 ac-ft
Taylor Park (IR)	56	54	58	55	106,200 ac-ft
Colorado–Big Thompson project (I)	48	48	69	57	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	72	72	79	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	73	73	74	56	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	30	27	57	58	1,000,000 ac-ft
Hetch Hetchy (MP)	10	8	30	27	360,400 ac-ft
Isabella (FIR)	12	12	30	26	551,800 ac-ft
Pine Flat (FI)	26	27	50	54	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	48	47	75	84	2,438,000 ac-ft
Lake Almanor (P)	58	60	56	48	1,036,000 ac-ft
Lake Berryessa (FIMW)	62	62	83	88	1,600,000 ac-ft
Millerton Lake (FI)	50	47	68	64	503,200 ac-ft
Shasta Lake (FIPR)	36	34	67	75	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	23	22	66	54	744,600 ac-ft
NEVADA					
Rye Patch (I)	66	69	104	88	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	85	84	79	64	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	1	1	12	18	1,073,000 ac-ft
Salt and Verde River system (IMPR)	48	47	62	43	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	24	24	24	76	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	18	19	30	29	2,539,000 ac-ft

[a] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

SELECTED SNOW SURVEY COURSES IN NORTHEASTERN UNITED STATES AND SOUTHEASTERN CANADA



SNOW SURVEY DATA

Map number	Snow course	River basin	Location			This season			Past seasons		Agency providing data*
			Elev. above MSL	Latitude	Longitude	Date of survey	Snow depth (inches)	Water content (inches)	Water content: Average	Water content: Years of record	
NS1	Caledonia	Medway	300	44°25′	65°03′	2/23	10.7	2.5	......	22	WSC
NS2	Mount Uniacke		500	44°53′	63°50′	2/23	10.7	1.5	......	30	...do ....
NS3	Copper Lake	South	320	45°23′	61°57′	2/23	1.9	0.7	......	17	...do ....
NS4	Oxford	Philip	120	45°43′	63°51′	2/22	18.1	5.0	......	17	...do ....
NS5	Margaree Valley	Northeast Margaree	150	46°21′	60°58′	......	....	....	......	19	...do ....
NB1	Moncton	Petitcodiac	150	46°04′	64°36′	2/24	29.5	7.1	4.9	16	...do ....
NB2	Pabineau Falls	Nipisiguit	100	47°30′	65°41′	2/3	32.3	5.8	......	.....	...do ....
NB3	Littleton	Miramichi	75	46°56′	65°55′	2/23	27.4	4.8	6.2	10	...do ....
NB4	Royal Road	N. Nashwaaksis	427	46°04′	66°43′	2/28	35.2	6.4	4.8	11	NBDOE
NB5	Elmcroft	Magaguadavic	300	45°16′	66°49′	2/23	19.3	3.8	4.0	15	WSC
NB6	St. Quentin No. 1	Restigouche	1,200	47°30′	67°15′	3/3	54.5	15.1	7.5	16	NBEPC
Q1	St-Moise	Mitis	775	48°31′	67°59′	2/26	59.6	16.8	9.9	16	QMS
Q2	Pelletier	Du Loup	1,200	47°34′	69°27′	2/27	57.9	14.8	10.0	18	...do ....
Q3	St-Theophile	Chaudiere	1,450	45°56′	70°31′	3/1	30.9	8.1	6.4	17	...do ....
Q4	Stanstead	St-Francois	1,250	45°03′	72°04′	3/2	27.5	6.1	7.4	17	...do ....
Q5	Pierreville	...do	75	46°04′	72°48′	2/28	30.0	6.8	7.0	17	...do ....
Q6	Mercier	Chateauguay	180	45°19′	73°45′	3/1	23.2	5.9	4.3	4	...do ....
Q7	Rivere Aux Ecorces	Reservoir Kenogami	1,400	48°11′	71°38′	3/3	44.7	13.4	8.4	19	...do ....
Q8	St-Michel-Des Saints	St-Maurice	1,300	46°42′	73°53′	2/27	33.6	7.0	5.8	12	...do ....
Q9	Depot-Forbes	Gatineau	1,230	47°13′	76°44′	......	....	....	6.5	11	...do ....
Q10	McWatters	Outaouais	960	48°13′	78°55′	2/27	41.3	10.0	6.7	20	...do ....
OT1	Brockville	Buell Creek	350	44°38′	75°43′	......	....	....	3.0	6	WSC
OT2	Madoc	Moira	650	44°31′	77°31′	......	....	....	4.2	18	...do ....
OT3	Squirrel Creek	Trent	625	44°11′	78°20′	2/15	11.5	2.6	......	.....	...do ....
OT4	Terra Cotta	Credit	1,125	43°43′	79°57′	2/16	7.6	2.8	......	.....	...do ....
OT5	Waldemar	Grand	1,490	43°54′	80°17′	2/14	18.0	6.4	......	.....	...do ....
OT6	Sebringville	Thames	1,190	43°24′	81°01′	2/11	20.8	6.8	......	.....	...do ....
OT7	Chesley	Saugeen	975	44°17′	81°02′	2/14	20.0	6.1	......	.....	...do ....
OT8	Kiwanis	Muskoka	1,300	45°27′	78°58′	2/15	31.0	5.3	......	.....	...do ....
OT9	Wishart	Root	725	46°34′	84°17′	......	....	....	7.3	4	...do ....
ME1	Alagosh "B"	St. John	640	47°05′	69°04′	2/28	48.0	11.3	......	.....	USGS
ME2	Telos	Penobscot	1,000	46°09′	69°07′	2/28	40.0	8.1	......	.....	BHEC
ME3	Moosehead	Kennebec	1,040	45°35′	69°43′	2/28	33.0	8.6	......	.....	KWPC
ME4	Amherst	Coastal	150	44°49′	68°22′	2/28	28.0	7.8	......	.....	BHEC
ME5	Augusta	Kennebec	160	44°19′	69°45′	2/28	22.6	7.9	......	.....	USGS
ME6	Middle Dam	Androscoggin	1,430	44°46′	70°55′	2/28	29.0	5.9	......	.....	UWPC
NH1	Cannon Mt. (Base)	Merrimack	1,950	44°10′	71°41′	2/28	35.0	9.3	......	.....	CE
NH2	Everett Dam	...do	460	43°05′	71°39′	2/28	20.0	5.2	......	.....	...do ....
NH3	MacDowell Dam	...do	960	42°54′	71°59′	2/28	18.0	4.9	......	.....	...do ....
VT1	Vershire	Connecticut	1,920	43°59′	72°22′	2/28	23.0	6.9	......	.....	...do ....
VT2	Proctorsville Gulf	...do	1,060	43°22′	72°38′	2/28	22.0	5.6	......	.....	...do ....
VT3	Ball Mt. Dam	...do	1,130	43°06′	72°48′	2/28	22.0	5.5	......	.....	...do ....
MA1	Lithia Post Office	Connecticut	1,180	42°27′	72°50′	2/28	14.0	3.5	......	.....	...do ....
NY1	Perry Mills	Lake Champlain	200	44°59′	73°31′	3/1	17.4	4.49	3.85	31	USGS
NY2	Sodom	Hudson	1,400	43°37′	73°59′	2/28	24.1	5.69	5.46	25	NMP-Albany
NY3	Slingerlands	Hudson	230	42°38′	73°53′	3/1	3.7	1.40	1.50	19	USGS
NY4	Margaretville	Delaware	1,340	42°09′	74°38′	2/28	3.6	1.30	1.07	30	...do ....
NY5	Pyrites	St. Lawrence	400	44°32′	75°11′	3/2	15.2	4.24	2.92	31	...do ....
NY6	Stillwater Reservoir	Black	1,700	43°54′	75°03′	2/28	34.8	10.56	6.60	34	BRRD
NY7	Northwood	Mohawk	1,250	43°21′	75°04′	3/1	28.2	8.00	6.12	32	NMP-Utica
NY8	Stillwater Dam	Eastern Oswego	970	43°33′	75°55′	2/28	53.1	18.15	6.80	32	NMP-Syracuse
NY9	Cortland	E. Susquehanna	1,130	42°36′	76°11′	2/28	6.0	2.54	0.98	25	NWS-Albany
NY10	Clyde (Lock 26)	Western Oswego	392	43°04′	76°50′	2/28	2.5	1.02	2.44	15	DOT-Syracuse
NY11	Canadice and Hemlock Lakes	Genesee	1,800	42°43′	77°35′	3/1	4.8	1.44	1.85	25	DPW-Rochester
NY12	Buffalo Airport	Lake Erie	705	42°56′	78°44′	3/2	4.0	2.9	.29	11	NWS-Buffalo
NJ1	Newton	Pequest	640	41°01′	74°47′	3/1	0.2	0.08	......	.....	USGS
PA1	Prompton-Jadwin Reservoir	Lackawaxen	1,600	41°36′	75°18′	3/1	0	0	......	.....	CE
PA2	Paradise Valley	Brodhead Cr.	840	41°07′	75°16′	2/28	2.6	0.75	......	.....	USGS
PA3	F. E. Walter Reservoir	Lehigh	1,700	41°07′	75°44′	3/1	4.0	1.3	......	.....	CE
PA4	Lyon Valley	Jordan Cr.	720	40°40′	75°40′	3/1	0	0	......	.....	USGS
PA5	Meyerstown	Schuylkill	660	40°24′	76°18′	3/1	0	0	......	.....	...do ....
MI 1	Alpena	Thunder Bay	689	45°04′	83°34′	2/28	9.0	3.0	......	.....	NWS
MI 2	Houghton Lake	Muskegon	1,149	44°22′	84°41′	2/28	10.0	2.2	......	.....	...do ....
MI 3	Lansing	Grand	841	42°47′	84°36′	2/28	1.0	....	......	.....	...do ....
MI 4	Detroit	Rouge	633	42°14′	83°20′	2/28	2.0	0.6	......	.....	...do ....

*Key: WSC – Water Survey of Canada; NBDOE – New Brunswick Department of Environment; NBEPC – New Brunswick Electric Power Commission; QMS – Quebec Meteorological Service; USGS – United States Geological Survey; BHEC – Bangor Hydro Electric Company; KWPC – Kennebec Water Power Company; UWPC – Union Water Power Company; CE – Corps of Engineers; NMP – Niagara Mohawk Power; NWS – National Weather Service; DOT – Department of Transportation; DPW – Department of Public Works.

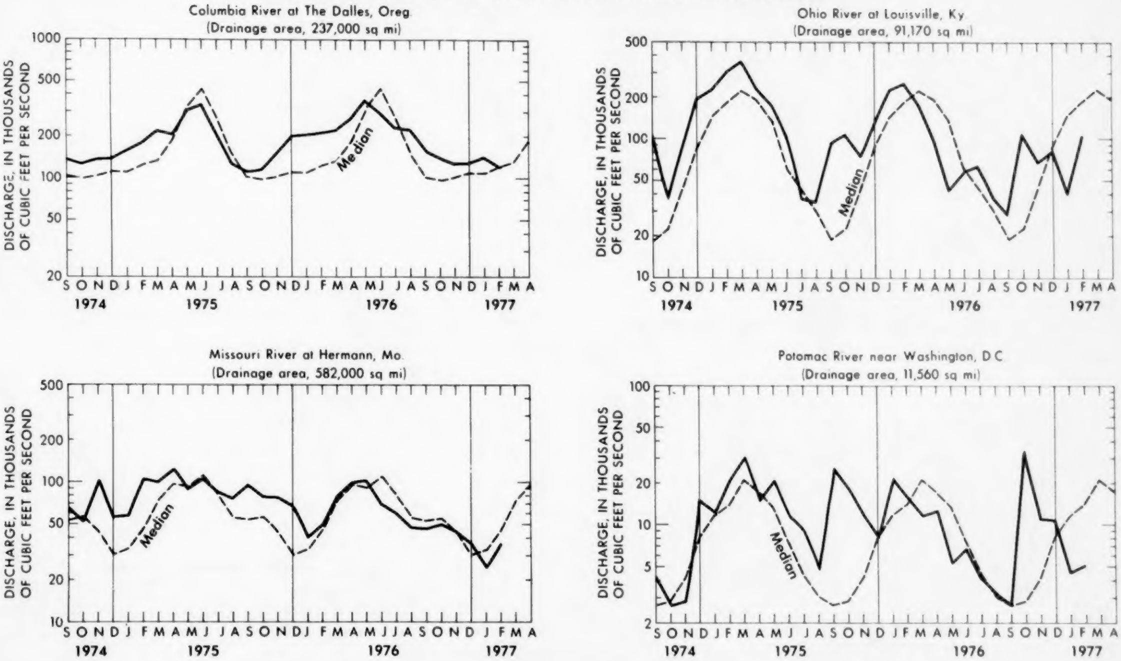
FLOW OF LARGE RIVERS DURING FEBRUARY 1977

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	February 1977: Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month (cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	1,532	80	-7	1,670	1,080	28
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	1,160	67	-19	1,500	970	25
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	2,476	51	-1	......	......	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	7,782	73	+43	24,440	15,800	27
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	22,840	62	+133	125,000	80,800	28
1–6465	Potomac River near Washington, D.C.	11,560	[1] 10,640	5,110	36	+13	5,500	3,560	28
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	2,822	32	-63	5,440	3,520	28
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	6,620	49	-60	6,320	4,080	23
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	16,480	87	-53	12,600	8,140	24
2–3205	Suwannee River at Branford, Fla	7,740	6,775	14,500	187	-29	11,300	7,300	28
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	22,160	75	-46	25,100	16,200	28
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	22,690	49	-47	52,200	33,700	25
2–4895	Pearl River near Bogalusa, La	6,630	8,533	7,500	50	-63	12,000	7,760	28
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	16,300	59	+184	57,900	37,400	28
3–0850	Monongahela River at Braddock, Pa.	7,337	[1] 11,950	17,200	96	+306	42,900	27,700	28
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	15,180	77	+154	54,000	34,900	25
3–2345	Scioto River at Higby, Ohio	5,131	4,337	3,576	46	+434	7,800	5,040	24
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	104,700	57	+155	266,200	172,000	27
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	9,049	27	+230	33,000	21,300	28
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1] 6,528	4,004	38	-37	......	......	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	1,640	45	+15	......	......	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	215,000	95	-3	228,000	147,000	28
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	6,520	85	+55	17,700	11,400	25
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	211	29	-2	210	140	28
5–3300	Minnesota River near Jordan, Minn ..	16,200	3,306	173	32	+14	204	132	22
5–3310	Mississippi River at St. Paul, Minn ...	36,800	[1] 10,230	1,705	40	+12	1,860	1,200	21
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	1,136	39	-8	......	......	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	4,236	70	+12	......	......	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	2,395	49	+65	5,200	3,360	28
5–4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	22,868	57	+32	41,000	26,500	28
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	153	12	+378	330	210	28
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	2,591	98	-6	2,700	1,750	28
6–9345	Missouri River at Hermann, Mo	528,200	78,480	36,340	80	+46	41,600	26,900	25
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	257,200	39	-7	350,000	226,000	28
7–3310	Washita River near Durwood, Okla ..	7,202	1,379	437	85	+46	300	190	28
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	377	72	+24	435	281	28
9–3150	Green River at Green River, Utah ...	40,600	6,369	1,674	71	-2	4,000	2,600	28
11–4255	Sacramento River at Verona, Calif ...	21,257	18,370	7,914	21	-12	8,200	5,300	25
13–2690	Snake River at Weiser, Idaho	69,200	17,670	13,580	75	-9	12,300	7,950	25
13–3170	Salmon River at White Bird, Idaho ..	13,550	11,060	3,922	87	+19	4,160	2,690	23
13–3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	3,837	42	+64	7,840	5,070	25
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	124,700	98	-13	......	......	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	4,651	11	-27	4,638	3,000	24–28
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	6,793	108	+55	7,200	4,650	28
8MF005	Fraser River at Hope, British Columbia.	83,800	95,300	44,400	149	-1	51,500	33,300	28

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge (unadjusted) determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

HYDROGRAPHS OF FOUR LARGE RIVERS



WATER RESOURCES REVIEW

FEBRUARY 1977

Based on reports from the Canadian and U.S. field offices; completed March 15, 1977

TECHNICAL STAFF	Allen Sinnott, Editor Carroll W. Saboe, Associate Editor Herman D. Brice Thomas H. Woodard Ruth M. Kosco John C. Kammerer
COPY PREPARATION	Lois C. Fleshmon Sharon L. Peterson Donna L. Radcliffe Stephanie F. Michie
GRAPHICS	Frances B. Davison Carolyn L. Moss Leslie J. Robinson Joan M. Smith

EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for February based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for February 1977 is compared with flow for February in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for February is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the February flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of February. Water level in each key observation well is compared with average level for the end of February determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of January to the end of February.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES–ARKANSAS-WHITE-RED REGION

The abstract and map below are from the report, ***Summary appraisals of the Nation's ground-water resources–Arkansas-White-Red Region***, by M.S. Bedinger and R.T. Sniegocki: U.S. Geological Survey Professional Paper 813-H, 31 pages, 1976. This report may be purchased for $0.85 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents.)

ABSTRACT

The Arkansas-White-Red Region, an area of 265,000 square miles (6.86×10^{11} square meters), is characterized by diversity in geography, climate, and geology and, in turn, by diversity in water resources and water problems. The western semiarid part of the region is water deficient, that is, potential evapotranspiration exceeds precipitation. The eastern, humid part has a surplus. Water use in the region in 1970 averaged 10 billion gallons per day (438 cubic meters per second), of which more than 65 percent was ground water. The largest use of ground water was for irrigation of crops (fig. 1), mostly in the water-deficient areas of Texas, Oklahoma, Kansas, and Colorado. Because of its ready availability and widespread occurrence, ground water is used throughout the region to supply municipal and rural water needs. The most productive aquifers, capable of yielding more than 50 gallons per minute (0.0032 cubic meters per second) to individual wells, are alluvium, carbonate rocks, gypsum, and sandstone. Fresh water in storage in aquifers in the region is estimated to be 2 billion acre-feet (2.5×10^{12} cubic meters). In addition, a large, unmeasured volume of saline water (containing more than 1,000 milligrams per liter of dissolved solids) underlies the fresh water at depths generally less than 500 feet (150 meters).

The flow of water in each aquifer depends upon the physical and hydrologic characteristics of the aquifer, the climate, and the relation to, and the character of, adjacent rocks and streams. These factors also determine the effect of water-supply development or other man-induced stresses on the flow and the quality of water in the aquifers. Analog and digital models of aquifers can be used to evaluate stresses on aquifers and thereby provide water managers and planners with efficient tools for planning the development and continued use of aquifers.

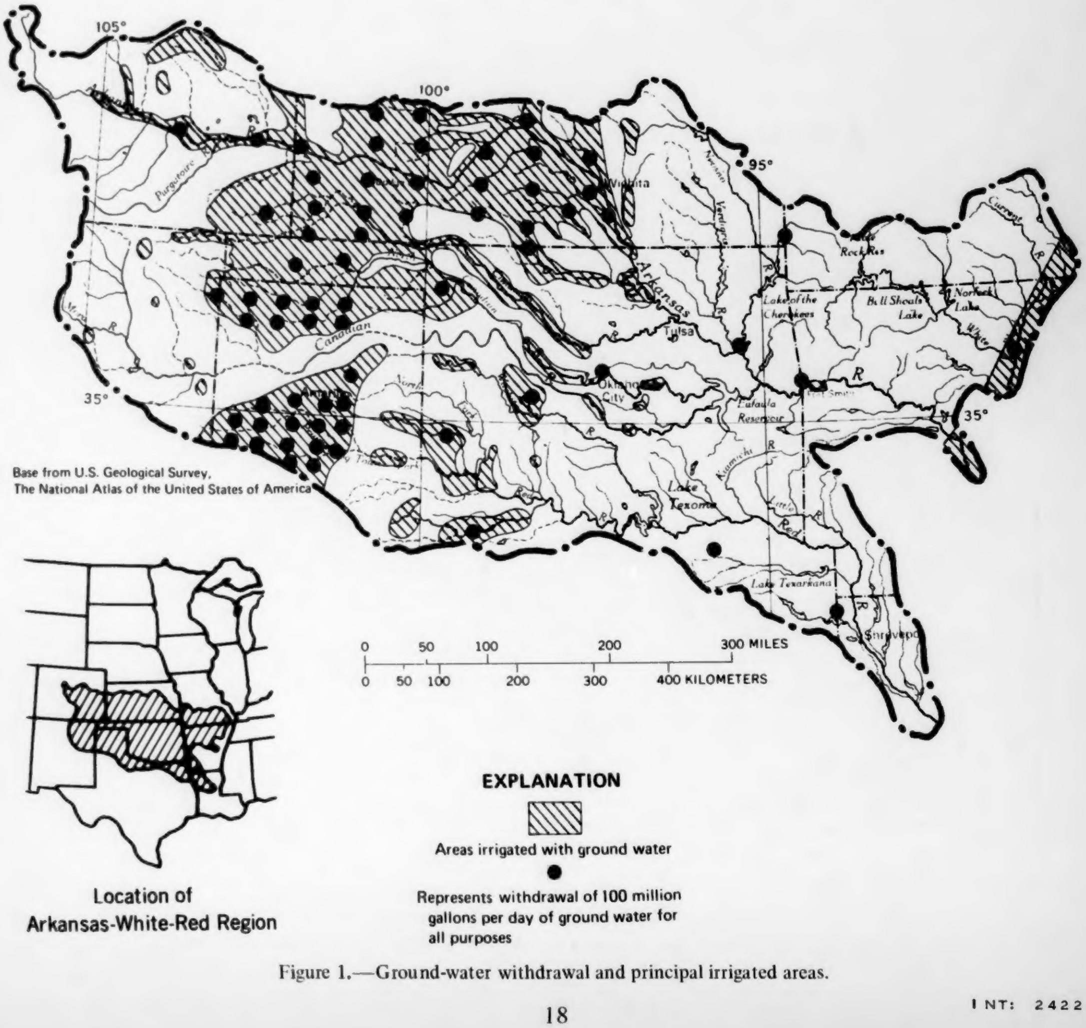


Figure 1.—Ground-water withdrawal and principal irrigated areas.